2016 6th IEEE International Conference on Control System, Computing and Engineering, 25–27 November 2016, Penang, Malaysia

Optimization of Hybrid Electric Vehicle Control for Efficient Performance at Critical Energy Levels

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***Abstract*— This paper proposes an optimization algorithm to regulate energy consumption and powertrain control of a hybrid electric vehicle (HEV). The algorithm is applied on a prototype vehicle manufactured by adding an electric motor to an all-terrain vehicle (ATV). The control system is designed using an embedded micro-controller unit (MCU). The main targets in this study are to improve the electric energy consumption efficiency and to reduce the ICE usage to minimum. The MCU controls the automatic switching between the electric motor and the internal combustion engine of the ATV. Furthermore, the system gives guidance for driver to use the limited resource efficiently at critical energy level. It restricts the driver performance using pulse width modulation (PWM). PWM duty cycle is adjusted to get optimum performance in term of maximizing the travel distance. Various driving scenarios are analyzed in this study. Factors such travel speed, energy level, stop-and-go frequency have been taken into consideration. The experiments showed significant improvement.**

***Index Terms*— Hybrid Electric Vehicle, Power Consumption Optimization, Embedded Systems, Optimal Control, Limited Resource Management.**